FOREST PEST MANAGEMENT
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AN EVALUATION OF PESTS IN THREE CAMPGROUNDS ON THE LOS PADRES NATIONAL FOREST

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ABSTRACT

Reyes Peak and Pine Mountain Campgrounds and Mil Potrero Organization Camp on the Los Padres National Forest were evaluated for pest conditions. The one disease present in all three campgrounds was western dwarf mistletoe infecting Jeffrey pine. Other pests found included the California flatheaded borer, annosus root disease, leafy mistletoe and pocket gophers. Mil Potrero Park had the most serious problems which will require a significant effort to rectify. On a forest-wide basis, we identified the need for a more complete hazard tree identification and management program. Alternatives to deal with the major pests in these recreation areas are discussed.

INTRODUCTION

The Los Padres National Forest requested pest evaluations of Reyes Peak and Pine Mountain campgrounds, Ojai Ranger District, and Mil Potrero Organization Camp, Mt. Pinos Ranger District. Our objectives were to assess the significance of dwarf mistletoes and root diseases already identified by the Districts and to provide input for future vegetation management plans. We were accomplished by Dave Schreiner, Supervisor's Office, and John Boggs, Ojai District.

REYES PEAK CAMPGROUND

OBSERVATIONS AND DISCUSSION: Much of this 8-unit campground is on a ridgetop dominated by old-growth Jeffrey pine, with scattered sugar pine and white fir. In general the campsites have very little regeneration while the area surrounding the campsites has more diversity of species and age-classes. The distribution of stems is erratic with some areas densely stocked and others without trees.

Both overstory and understory Jeffrey pines are infected with western dwarf mistletoe, Arceuthobium campylopodum, and trees representing all classes of infection (1-6, Hawksworth System) are present. (The biology of each pest mentioned is described in the Appendix.) Understory sapling pines are the most severely infected trees. Many large flat-topped pines along the ridge look severely infected and appear to have witches' brooms, when much of this distortion is probably due to the effect of wind. Even though dwarf mistletoe is highly visible in this recreation area, its overall impact appears to be slight to moderate.

There has been very little recent mortality; a few pole-size Jeffrey pines had been killed by dwarf mistletoe and the California flatheaded borer, Melanophila californica. A group of older dead pines showed some charcteristics of a root disease center, but we found no evidence of root disease fungi. Several of these trees had broken off at the butt and revealed old healed-over fire scars and extensive heartrot.

A few of the larger white fir had dead tops associated with true mistletoe, Phoradendron bolleanum spp. pauciflorum. Sugar pine appeared to be relatively pest-free and the most vigorous species in the area.

MANAGEMENT ALTERNATIVES

1. Do Nothing. This alternative allows the campground vegetation to grow without any manipulation. As trees grow, basal area will increase and overstocked aggregations of trees will come under additional stress that may subject them to successful bark beetle attacks. The result may be groups of dead trees. Extended periods of drought would accelerate the normal gradual increase in inter-tree competition due to growth and cause more abrupt changes in the number and distribution of killed trees.

Although dwarf mistletoe is not seriously damaging Jeffrey pine in the campground, it will continue to intensify within infected trees and spread to uninfected trees, including any natural regeneration or planted Jeffrey pine. As trees become more severely infected they are more susceptible to insect attacks and will die sooner than healthy pine. Left unmanaged, dwarf mistletoe infested stands gradually deteriorate.

Problems associated with old-growth trees, especially heartrot and bole failures, may become more frequent. Mature pines and firs with large fire scars often contain advanced decay, and may be hazardous. True mistletoe infections on white fir will probably increase; but because this parasite is vectored by birds, its spread and build-up is unpredictable. In summary, without any management activity, there is no control over which or how many trees are removed by these natural pressures.

2. Manage the campground vegetation. This alternative carries with it two requirements. First, the Forest and District must be committed to invest time, labor and dollars toward the long-term health of their campgrounds. Second, a

vegetation management plan is required that clearly defines the desired campground characteristics including the relative importance of items such as overstory trees, understory trees, screening, shading, species diversity, distribution of size or age classes, and hazardous trees. Without these priorities it is very difficult to make decisions on what should be done to improve or maintain the vegetation. Elements to consider under this alternative for Reyes Campground are described below.

A. Stocking control. Thinning to reduce the basal area of overstocked aggregations will provide trees with more tolerance to insect attack and drought stress. Guidelines for thinning can be based on spacing criteria or on basal area targets appropriate for the site. Planting openings or understocked areas would provide screening, shading and future overstory replacement trees. Also the diversity of species can be enhanced if trees other than Jeffrey pine are planted. Consider that white fir, sugar pine, and native brush species are not susceptible to the dwarf mistletoe affecting Jeffrey pine.

B. Dwarf mistletoe control. As this parasite becomes more injurious to Jeffrey pine in the campground, the District may decide to reduce its impact either as part of campground rehabilitation or as a separate control project. Even though dwarf mistletoes build up rather slowly, the longer that control steps are put off, the more drastic the treatment will have to be. A control project done soon would significantly reduce the future impact of dwarf mistletoe. Suppression projects include removal of heavily-infected trees, pruning to remove all infections, and pruning to remove only witches' brooms in order to prolong tree life. Thorough treatments will reduce average dwarf mistletoe stand ratings to a level where the pest will not have a significant impact for many decades. Initially the District would need to rate each infected tree and decide on the appropriate treatment for that individual. Forest Pest Management can provide more detailed guidelines for dwarf mistletoe control projects and possible FPM funding.

C. Hazard tree program. Campgrounds should be formally inspected on a regular basis to identify hazardous trees. Trees rated as high hazards should be promptly removed. The rating system used in these surveys is not as crucial as maintaining the results of each survey. Districts often conduct inspections, but fail to keep written records that will provide continuity if changes in personnel occur. All trees that are judged as hazardous should be mapped and described so an inspector can refer back to older survey records and determine whether a change in the degree of hazard has taken place. (Refer to the Literature section at the end of this report for a list of articles describing hazard tree programs.)

Remember that any activities in recreation areas involving tree removal will also require treating stumps with borax to prevent annosus root disease.

PINE MOUNTAIN CAMPGROUND

OBSERVATIONS AND DISCUSSION. This facility has six units in an area that is exclusively Jeffrey pine. The old-growth overstory is fairly sparse and provides an open park-like appearance; there is no regeneration. The only pest present is western dwarf mistletoe, but it is not seriously affecting the pine. Most of the mistletoe could be removed by pruning the lower crown of infected trees.

MANAGEMENT ALTERNATIVES. The same two alternatives described for Reyes Campground are applicable here. Again, if the vegetation is to be managed, a clear statement of objectives is needed. For this area we would emphasize the importance of establishing some type of understory, preferably species other than Jeffrey pine. Loss of a few key overstory pines would create very large openings in the campsites. If Jeffrey pine is the only suitable tree for regenerating the site then the dwarf mistletoe should be treated before any pines are planted.

MIL POTRERO ORGANIZATION CAMP

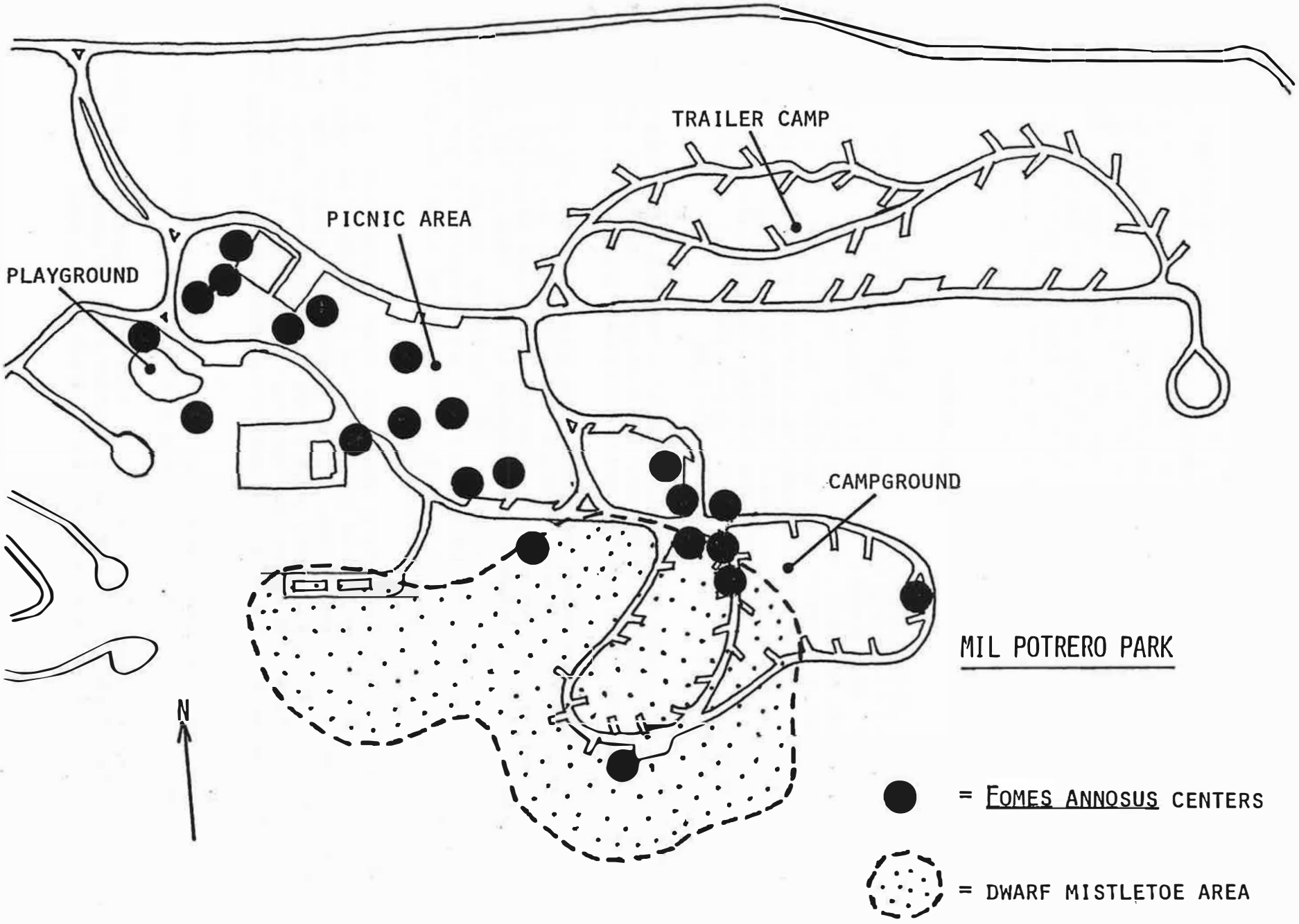
OBSERVATIONS AND DISCUSSION

This facility contains a playground, picnic area, campground and trailer camp (see map on next page). The vegetation throughout the Camp consists of various stockings and proportions of Jeffrey pine and pinyon pine with scattered live oak. Rabbit brush and sage brush are common in open areas. A sparse overstory of Jeffrey pine, with diameters up to 30 inches, dominates the west end of the park and as one moves to the east, pinyon pine becomes more frequent and the average size of Jeffrey pines decreases.

Forest Pest Management records indicate that Fomes annosus root disease and western dwarf mistletoe of Jeffrey pine were identified in the Park in 1978. However, no attempt was made then to assess their significance or offer management alternatives. This report addresses both of these points.

Annosus root disease and dwarf mistletoe are seriously effecting much of the campground vegetation. Root disease centers are concentrated throughout the playground and picnic areas and are more sparsely scattered within the campground (page 5). Recent pocket gopher activity indicated by fresh mounds appeared heavy in root disease centers and other open areas. Dwarf mistletoe is present along a strip in the southern portion of the Park beginning near the Manager's residence and extending well into the campground. These pests overlap in some locations, but neither was found in the trailer camp.

Fomes annosus has created large openings in the eastern end of the Camp, and pocket gophers are keeping these openings free of regeneration. Many pine stumps are present here and most contain F. annosus conks. Jeffrey pine and California black oak have been planted in these disease centers during the past seven years, but most of the pine and almost all of the oak have died. We suspect that pocket gophers were a major cause of seedling losses for pine and oak, while annosus root disease may have killed some of the pine.


TRAILER CAMP
PICNIC AREA
PLAYGROUND
CAMPGROUND
N
MIL POTRERO PARK
= FOMES ANNOSUS CENTERS
= DWARF MISTLETOE AREA

Almost all of the pines within the area of dwarf mistletoe infestation are currently infected by this parasite. Individual mistletoe ratings (Hawksworth system) for most trees range from moderate to severe, which means these trees are already under significant stress. They cannot be expected live for nearly as long as healthy trees; severely infected trees are prime targets for bark beetle colonization and are often the first trees to die during periods of drought. Our overall impression is that dwarf mistletoe has been left uncontrolled for so long in the Park, that some areas are beyond help except to eliminate the existing Jeffrey pine and start over. In other areas selective tree removal and pruning would be effective and beneficial. Dwarf mistletoe suppression will be discussed more fully in the Alternatives section.

ALTERNATIVES

I. Continue present management. Trees are removed after they die, regardless of cause, and periodically portions of the Park are replanted. This level of activity does not prevent any future mortality, and, therefore, trees will continue to die, especially on the perimeter of root disease centers. Occassionally trees with severe dwarf mistletoe will be killed. Tree death due to mistletoe and attendant beetle attacks can increase dramatically during periods of below normal precipitation. Dwarf mistletoe will continue to spread and intensify as long as pine hosts are present. Regeneration efforts may or may not be successful depending on the species and size of trees planted and the amount of care given to seedlings after planting.

II. Develop and follow a complete vegetation management plan. Alternatives or elements that should be addressed in a campground management plan for Mil Potrero, at least from a pest management standpoint, are discussed below.

A. Regenerate openings and understocked areas. A successful revegetation program will require a serious, thorough effort, taking as many precautions as possible to ensure tree survival. Conifers should not be planted in annosus root disease centers; hardwoods are resistant to this disease and offer the best opportunity for revegetation. All hardwoods and any conifers except Jeffrey, ponderosa, Coulter and knobcone pine are resistant to western dwarf mistletoe. Live oaks may be a good choice for planting since there are several in Mil Potrero that appear quite thrifty.

Many attempts at establishing hardwoods (most often oaks) in southern California recreation areas have failed, and for a variety of reasons. We feel that the larger a planted hardwood is, the greater its chances for survival are, although it takes several years (5-10) to produce these trees. Physical barriers will offer some protection from pocket gophers and may also prevent damage from people and pets. Watering these trees during the summer is also necessary.

No planting should be scheduled without first evaluating the pocket gopher population and considering the following control options.

1. Trapping. This method is very time consuming and is practical only on small areas or as a supplement to other forms of control. It is also effective to keep populations at low levels after initial control efforts.

2. Fumigation. Several materials are registered for fumigating, but the extent of pocket gopher burrow systems and their ability to plug off burrows make the use of gas unsatisfactory and relatively expensive.

3. Baiting. Hand baiting with strychnine-treated grain placed in gopher burrows is the most practical and effective method of direct control. Treatment effectiveness is best when there is fresh mound-building activity and when soil moisture is adequate to prevent collapse of the burrows. These conditions usually occur during late fall and early spring. The ability to irrigate in the Camp would make control possible any time fresh activity occurs. In 1982, costs for gopher baiting on another southern California National Forest averaged between $17 and $22 per acre. This method could be safely used when the Park is open, but would probably be best used when the Park is closed. Because the bait is placed underground and most gophers die in the burrow system, secondary-poisoning and nontarget hazards are minimal.

4. Physical barriers. Individual seedling protectors like "Vexar" have provided short-term protection to seedlings. However, long-term efficacy and effects on trees are still under study. Physical barriers alone will not prevent damage to established trees and shrubs. This approach is most effective when integrated with other control methods.

5. Habitat manipulation. Control of grasses and forbs can be effective in improving seedling survival by preventing population increases or by making habitats less suitable for gophers, while also reducing vegetative competition. This approach will not eliminate problems but may substantially improve the effectiveness of direct control. Often time, control or removal of vegetation in campgrounds is not consistent with management objectives.

B. Control Fomes annosus.

1. Prevent stump infections. Application of granular borax to all freshly cut conifer stumps is 90% effective in preventing new infection centers from becoming established. This treatment is directed by the Forest Service Manual for all developed recreation sites in California National Forests. The chemical is toxic to spores of F. annosus, but has no effect on existing underground infections. Borax treatments require a Pesticide Use Proposal which must be approved by the Forest Supervisor.

2. Stump and root removal. Removing as much infected stump and root material as possible may disrupt the underground means of disease spread. After any remaining root material has been completely decayed, the site will be suitable for conifer regeneration. Recently cut stumps within a disease center, both infected and uninfected, could be pushed or pulled out, but rotten stumps would have to be dug out, or possibly burned out. Even though removal of infected material from the ground should stop disease spread and reduce the amount of time before conifers can again be planted, its effectiveness has not been demonstrated under California conditions.

3. Utilize root disease openings. This alternative is most applicable when developing new areas, expanding existing areas or redesigning campgrounds. It is possible to utilize openings for parking lots, restrooms or other facilities rather than removing trees to make space for them. Remember

that additional mortality, possibly creating hazardous tree conditions, may eventually occur around the edges of these areas as the fungus continues to spread underground. Finally, it may be that some root disease centers are compatible with management objectives, or at least not a major problem, depending on their size and location. In this case they could be left untreated for several decades and then replanted to conifers.

C. Control Dwarf Mistletoe. Direct suppression is a relatively straightforward and effective approach to managing dwarf mistletoe. The District, however, must first accept that dwarf mistletoe is negatively impacting Mil Potrero and then decide whether the benefits of control are worth the cost and effort. Definite campground management priorities and control objectives must be set before any project is begun.

Basic treatments for mistletoe in recreation areas include 1) removing heavily infected trees, 2) pruning to remove all branch infections, and 3) removing only witches' brooms. Initially, it is necessary to complete a pre-suppression survey which requires each tree to be examined and rated for dwarf mistletoe infections. The decision for individual tree treatment is based on this rating and the oondition and position of adjacent trees.

Forest Pest Management can provide more detailed guidelines for suppression projects and treatment decisions. Also, there may be FPM funds available for suppression projects depending upon the number of other project proposals submitted within the Region and the expected biological and economic effectiveness of the projeot. Please contact our staff if the District decides to pursue a suppression project.

APPENDIX

Biology of Pest Organisms

ANNOSUS ROOT DISEASE

Fomes annosus attacks most conifers in California. The fungus spreads long distances above ground by air-borne spores; these are produced by conks in decayed stumps, under the bark of dead trees, or under the duff at the root collar. The spores land on freshly-cut stump surfaces or on wounds in living trees, germinate, and colonize the exposed wood.

Once established in a stump or tree, the fungus grows into and through the host roots until it contacts the roots of nearby trees, where it infects and invades their root systems. In this way, F. annosus spreads from stumps or dead trees into the roots of living trees in an enlarging infection center. The fungus may also spread through roots into adjacent fresh stumps or recently-dead trees, but only if they are not already colonized or decayed by other fungi.

F. annosus can remain viable in old infected roots or stumps for as long as 50 years. Infection centers usually continue to enlarge until they reach natural barriers such as openings or groups of non-host plants. Young conifers established within infection centers often die shortly after their roots contact infected roots in the soil.

This root pathogen affects pines and true firs in different ways. It kills pines relatively quickly without causing extensive decay. The fungus spreads through the inner bark and sapwood of the pine root systems, killing these tissues; within 2-6 years it reaches the root crown and girdles the tree. By contrast, true firs are seldom directly killed. The fungus kills small fir roots and spreads into the heartwood of the larger roots, and then into the lower bole of the host, where it causes a butt rot. Vigor and merchantable volume are reduced. If the fir does die it is usually the result of root disease and subsequent insect attack.

Generally, firs growing within pine disease centers are highly susceptible to annosus infection, while pines adjacent to infected fir stumps usually escape attack. Thus, large fir infection centers can be revegetated by selecting for or planting pines.

CALIFORNIA FLATHEADED BORER

Most species of pine are hosts for the California flatheaded borer, Melanophila californica. Females lay eggs in bark crevices of host trees during summer. Larvae hatch and bore into the cambium. They feed for a period of a few months to 4 years, depending on host vigor. The small larvae cut thin mines in a serpentine pattern across the cambium.

If the host is relatively vigorous and the small larvae are not abundant, the larvae will die and their mines will be callused over. Larval mines and host scar tissue can block conductive tissues and cause general tree weakening. If the health of the tree declines, small larvae develop rapidly and kill the cambium. They pupate in the bark and emerge as adults in as little as one year

after the tree was infested, although some larvae survive in green trees for several years.

The California flatheaded borer commonly kills pines growing on rocky slopes, in fringe-type stands, or in other situations where soil moisture is insufficient for normal tree growth. It is often found in trees weakened by dwarf mistletoe, root disease or old age. This species is of primary importance in weakening trees and causing them to become susceptible to pine bark beetles.

DWARF MISTLETOES

Dwarf mistletoes are parasitic, flowering plants, in the genus Arceuthobium, that can survive only on a living host. They obtain all their water, nutrients, and minerals from the host.

The parasite spreads by means of seed. In the fall the fruit ripens, detaches from the aerial shoot, and the seed is forcibly discharaged. The seed is covered with a sticky substance, and adheres to a needle or twig, where it will remain throughout the winter. The following spring it may germinate and penetrate into the tree. For the next two to four years, the parasite will grow within the twig and develop a root-like system in the inner bark and outer sapwood. It will then develop aerial shoots that produce seed in another two to four years.

The spread of dwarf mistletoe is limited to the distance traveled by the seed, which from overstory to understory is usually 20 to 60 feet; with the aid of wind, the seed may occassionally be carried as far as 100 feet. A rule of thumb is that dwarf mistletoe can spread a horizontal distance equal to the height of the plant in the infected tree. Because of the various limits to spread, the actual spread rate through an even-aged stand is usually one to two feet per year.

Some dwarf mistletoes parasitize only one species of conifer. Others may occur on three or four closely-related species, but only rarely do they cross-infect from one conifer genus to another. Because of their specificity, the dwarf mistletoe species can be identified by the hosts they infect.

The impact of dwarf mistletoe varies on different species and is significantly influenced by tree vigor. For example, the impact of dwarf mistletoe is less on true fir than on pines; its impact on vigorously-growing trees is less than on slow-growing or stagnated ones. Nevertheless, the dwarf mistletoes are the most serious forest disease agents in much of the West, causing extensive growth losses and predisposing conifers to attack by insects and other pathogens.

POCKET GOPHER (Thomomys bottae)

Pocket gophers live in closed burrow systems and spend most of their time below ground. The cresent-shaped mounds and plugged burrow entrances are major signs of gopher presence and activity. These animals are solitary except during the breeding season and when young are being raised. Pocket gophers eat succulent underground parts of plants, although they may graze aboveground on plants near

burrow openings. Breeding ocurs in early spring when green forage is plentiful, and litters of 4 to 8 young are born after a gestation period of 18 to 19 days. An annual turnover of more than 75 percent of the population is common. Young disperse, usually aboveground, in late summer. Mound-building activity is most common during the late summer or early fall when young are dispersing and establishing their own burrows and adults are enlarging their systems in preparation for winter. Pocket gophers are active year round and even burrow through snow. Where preferred forbs and grasses are lacking, pocket gophers may feed on the roots of large trees.

TRUE MISTLETOES

Like the dwarf mistletoes, the true mistletoes (genus Phoradendron) are flowering plants that require a living host. They are generally less demanding of their hosts than the dwarf mistletoes, yet can be serious pests where individual trees are of high value, as in yards, parks, and campgrounds.

Some species of true mistletoe grow on only a single genus of tree; others occur on a wide range of hardwoods. Although they are completely parasitic, they manufacture many of their nutirents by photosynthesis and usually require only water and minerals from their hosts. However, if the green aerial shoots of the mistletoe are removed, the root system of the parasite can utilize the hosts's nutrients and remain alive within an infected branch for many years.

True mistletoe infections are spread mainly by birds - including robins, bluebirds, thrushes, and cedar waxwings - that feed on the berries. Birds digest the pulp of the berries and excrete the living seeds, often depositing them onto susceptible trees. A viscous coating and hair-like threads on the outer surface of the seeds attach them firmly to twigs and branches, where they germinate and infect the host tissues.

Young or small trees are seldom infected by leafy mistletoe. In nearly all cases, initial infection occurs on larger or older trees because birds prefer to perch in their tops. Severe buildup of mistletoe often occurs in an already-infected tree because birds are attracted to and may spend prolonged periods feeding on the mistletoe berries.

Trees heavily infected by mistletoe are weakened, reduced in growth rate, and sometimes killed. Weakened trees are predisposed to attack by insects and often succumb during drought or other periods of stress. Branches heavily-laden with mistletoe often break during storms of high winds, and trunk swellings may provide an entrance point for decay fungi, increasing the hazard to people and property in campgrounds and other developed sites.

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